NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BAMS	**LEVEL:** 5
COURSE CODE: LIA502S	**COURSE NAME:** LINEAR ALGEBRA 1
SESSION: NOVEMBER 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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INSTRUCTIONS
1. Answer ALL the questions in the booklet provided. 2. Show clearly all the steps used in the calculations. 3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 3 PAGE (including this front page)

QUESTION 1 (23 marks)

1.1 If $u=(2,-7,1)$, $v=(-3_1,0,4)$ *and* $w=(0,5,-8)$ are vectors in R^n Find

1.1.1 *3u-4v.* [3]

1.1.2 *2u+3v-5w.* [4]

1.1.3 If $u=\begin{bmatrix}5\\3\\-4\end{bmatrix}$, $v=\begin{bmatrix}-1\\5\\2\end{bmatrix}$, $w=\begin{bmatrix}3\\-1\\-2\end{bmatrix}$ Find

(a) 5u-2v [3]

(b) -2u+4v-3w [4]

1.2 Suppose $u=(1,-3,4)$ and $v=(3,4,7)$ Find:

1.2.1 $\cos\theta$, *where* θ is the angle between u and v; [2]

1.2.2 $proj(u,v)$, the projection of u unto v [3]

1.2.3 $d(u,v)=\|u-v\|$ the distance between u and v [4]

QUESTION 2 (21 marks)

2.1 Find AB if $A=\begin{bmatrix}2 & 3 & -1\\4 & -2 & 5\end{bmatrix}$ and B=$\begin{bmatrix}2 & -1 & 0 & 6\\1 & 3 & -5 & 1\\4 & 1 & -2 & 2\end{bmatrix}$. [8]

2.2 Find the sum $C=B^T+E$ where E is the matrix $\begin{bmatrix}1 & 1 & 1\\2 & 3 & 1\\3 & 1 & 0\\-1 & 4 & 0\end{bmatrix}$.

Using matrix B as in question 2.1 [8]

2.3 If $D=\begin{bmatrix}2-3i & 5+8i\\-4 & 3-7i\\-6-i & 5i\end{bmatrix}$ Find D^H the Hermitian matrix of D [5]

QUESTION 3 (24 marks)

3.1 If $A=\begin{bmatrix}1&1&1\\0&1&2\\1&2&4\end{bmatrix}$ Find $A^{-1}=\begin{bmatrix}x_1&x_2&x_3\\y_1&y_2&y_3\\z_1&z_2&z_3\end{bmatrix}$ [8]

3.2 If $B=\begin{bmatrix}1&2&-1\\2&0&-3\\3&1&4\end{bmatrix}$ determine $g(B)$ if $g(t)=2t^2-3t+2$ [8]

3.3 The sum of three numbers is twenty short of a hundred. The second number is twenty eight less than the sum of the first and the third numbers. The first number is six less than the third. Model this word problem as a system of linear equations and solve the system, using row operations, to determine the values of each of the three numbers. [8]

QUESTION 4(17 marks)

4.1 Write the vector v = (4, 9, 19) as a linear combination of

$u_1=(1,-2,3),\ u_2=(3,-7,10),\ u_3=(2,1,9).$ [10]

4.2 Use Cramer's rule to find the value of x_2 in the following system of linear equations

$$\begin{aligned}2x_1+3x_2-x_3&=-3\\x_1-2x_2+4x_3&=1\\3x_1+2x_2+x_3&=-2\end{aligned}$$ [7]

QUESTION 5 (15 marks)

5.1 Compute and sketch the linear combination,

$\frac{1}{2}v_1-3v_2$ where $v_1=\begin{bmatrix}2\\4\end{bmatrix}$, and $v_2=\begin{bmatrix}-1\\1\end{bmatrix}$ [10]

5.2 Prove that if U and W are subspaces of a vector space V, then

$U\cap W$ is a subspace of V. [5]

END OF EXAMINATION